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IS THE ADULT CONDITION OF AN APHID DETERMINED WHEN IT IS BORN?*

ARTHUR C. MASON

Most aphids which are eventually to develop wings will, upon close examination, show wing pads, especially when approaching maturity. On some species these show distinctly, but on others not so plainly. Usually they are not very noticeable until the last instar preceding maturity. The question now arose as to whether the adult form of the aphids was determined when it was born. Was it possible to prevent, under favorable conditions, an aphid which had wing pads from developing wings, or to cause, through unfavorable conditions, an aphid without pads to develop wings? To determine this point some experiments were planned.

Twelve specimens of *Lachnus pini* in the first instar and showing wing pads were placed on a pine branch in a cage on the tree and allowed to mature. Also twelve specimens not showing wing pads were placed in a second cage. Of the first group all developed wings, while in the second lot there were both winged and apterous forms. A probable error in this work lies in the fact that it is not possible to tell exactly if a small aphid has pads and consequently some of this lot undoubtedly had pads while in the other lot only those were selected which plainly showed wing pads. This experiment was repeated the same way on cut branches of pine under bell jars in the laboratory. The results were similar to those of the preceding experiment, all of the first group developing wings while the second had both winged and apterous forms. The same probable error occurs here also.

A similar experiment was next tried with *Myzus persicae*. In this species however it is much harder to distinguish those hav-

*Continued from Vol. VI, No. 2, p. 32.

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ing pads from those without them, until just before the last molt. However, some attempts were made to select some without and try to produce wings on them. Twelve immature specimens were placed on each of four cuttings of orange tips in sand. A and B were watered with a 3% magnesium sulphate solution, and C and D were watered with distilled water. The results showed both winged and apterous forms developed with a majority of winged in all cases. The number in the two checks was about equal to the number in the treated jars. A second trial using only one individual on each cutting produced similar results. Those on stems in magnesium sulphate solution were all apterous and those in water were half winged and half apterous. Four checks tied up on a limb of an orange tree resulted in three winged and one apterous. On these results it is probable that the cause of wing production was due to wrong selection of aphids rather than to a change of conditions. The checks also produced wings. It is practically impossible to select aphids of this species, when young which we can tell with certainty will not develop wing pads.

One more experiment was run on aphids of this species whose lineage was known. Four specimens of *Myzus persicae* were selected from the lines used in the life history work. Their parents had been apterous for four generations back. They were all kept on a cabbage plant until eight days old and then two of them, C and D, removed each to a separate orange tip in sand and watered with distilled water. The other two, A and B, were left on the plants for checks. All matured apterous. A and B together then raised 17 young on the cabbage plant of which sixteen were apterous and one winged. C on orange tip raised five young, all apterous. D on orange tip raised five young, four apterous and one winged. In the third generation raised from C and D there were together forty-six apterous and five winged aphids. Hence it is seen that even in the second and third generations the number of winged forms on the cut stems is not increased over those on plants growing naturally.

ALTERNATION OF WINGED AND APTEROUS GENERATIONS

The question arose as to the possibility of there being an alternation of one winged generation with one or more apterous generations. To investigate this point some colonies of the pine aphids were started on a small pine tree. Four winged adults reared a family the majority of which were apterous and four apterous

adults reared a family the majority of which were winged. From each of these families some winged and apterous individuals were selected and the work continued for three generations. These results show that there is a distinct alternation of winged and apterous forms of *Lachnus pini.* In the case of four lines run for three generations there was in every case a majority of apterous young from winged parents and of winged young from apterous parents, and in some cases it was 100 per cent. This work was then continued by rearing the aphids on cut stems in the laboratory in both water and salt solution with checks on a growing tree. Here with one exception the same phenomenon was observed. In all, twelve winged adults from whom families were reared and counts of the offspring made produced an average of 72.1% apterous young; and in the case of six apterous females there was an average of 93.1% winged young. In several other cases of each form a majority was observed to exhibit this alternation of generations but no counts were made. As the results show, the cut stems had no influence in changing this proportion. So we conclude that even if the aphids are reared on unhealthy or dying stems the effect will not counteract the alternation of winged and apterous forms.

In practically all cases the first few young from a winged parent were apterous and vice versa. This may account for the fact that the percentage is perfect in some cases where the adult lived only long enough to raise a few young. The percentage of winged young from apterous parents is higher than that of apterous young from winged parents. The alternation of winged and apterous forms accounts for the fact that winged forms were observed in the field only at certain intervals. A winged adult might fly to a new tree and start a colony which would be all apterous. These would then produce families which would be largely winged. However, nearly a month would be consumed before the winged ones would become adult, during which time no winged forms would be seen, and then within a few days many winged ones would appear. This was observed on several different occasions.

SUMMARY

We can draw the general conclusion from all of these experiments that external conditions and environmental changes do not effect the production of winged forms of aphids, at least not in the first generation. This was proven by confining aphids on injured and dying pine trees, by raising aphids on cabbage plants show-

ing effect of injury and drought, by crowding aphids on a limb, and by adding chemical solutions to their food in growing plants, cut stems, and injections in growing stems. In no instance was a larger number of winged forms of aphids produced than in the checks living under natural conditions.

It is generally believed that an aphid will develop wings and fly away if its host plant dies or if crowding lessens the food supply and endangers its existence. In the case of mature pine aphids this was not found to be true. They all died when the host plant dried up. In fact it is unreasonable to believe that they can develop wings after maturity. Grove (19)[1] has made a careful study of the anatomy of winged and apterous aphids, and finds distinct differences, not only in external characters but also in the internal anatomy, such as the nervous system, the tracheal system, the size and shape of the alimentary canal, etc. Therefore, if an aphid were to develop wings due to unfavorable external conditions it must change its entire anatomy, and this probably is beyond the power of any organism.

A young aphid when born has its adult conditions as regards presence or absence of wings already determined, and no change of environment can effect this. First instar nymphs of both *Lachnus pini* and *Myzus persicae* which showed wing pads developed wings in every case, even though kept under the most favorable condition. On the other hand, young aphids which did not show wing pads developed apterous when raised under adverse conditions.

In the case of *Lachnus pini* an alternation of winged and apterous forms was determined. Although not exhibiting a perfect alternation, the offspring of each individual showed a majority of the opposite type. No changes in environment such as injury to host, crowding, or adding chemicals to the food of the host would change this alternation. A majority of apterous forms was always obtained from winged parents even under unfavorable conditions of life. With *Myzus persicae* and *Aphis gossypii* this alternation does not exist, since several generations were raised without securing any winged forms.

Kellogg (23) says that Clarke was able to produce winged forms of aphids at will by changing the sap of the host plant through addition of chemical salts. He used tip cutting of rose stems in sterilized sand and watered with solutions of magnesium salts of varying strengths. In this way he says he pro-

[1]Numbers refer to references cited.

duced winged forms of the rose aphid *Nectarophora rosae.* As shown above this was not true in the case of another species of rose aphid. No winged forms were produced even when the second and third generations were raised on cuttings in salt solutions by transferring the aphids from one cutting to another as often as they showed signs of wilting. In the same way three generations of *Myzus persicae* were raised on orange cuttings with no noticeable effect as compared with the checks on growing trees. Two generations of *Lachnus pini,* and one of *Aphis gossypii* were also raised on cuttings in solutions of magnesium, of sodium, and of citrus acid, and in all cases without results to substantiate Clarke's statement.

Morgan (24) in discussing Balbiani's work of raising sexual and parthenogenetic forms of aphids says that a female producing parthenogenetic young continued to produce them when placed on a dying stem. He concludes that food does not effect the mode of reproduction unless the organism is "predisposed to submit to its influence." In another paper Morgan (25) gives the results of several attempts to produce sexual aphids, and finally concludes that sexual forms are not due to external conditions, however important these factors may be in cyclical changes in sex production. We can also say the same regarding wing formation in aphids.

External conditions must require more than one generation to produce their effects, and when once effected the condition of that individual cannot be altered. Even in the second and third generations no positive results of their influence on wing formation were obtained.

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PERSONAL NOTES OF MEMBERS

We note from Baldwin-Wallace Alumnus that Dr. Carl J. Drake, head of the Department of Entomology of the Iowa State College, has just recovered from a severe attack of pneumonia.

Dr. H. L. Dozier has resigned from the U. S. Bureau of Entomology where he had charge of the Camphor Scale investigations, to take the position of Entomologist to the Gulf Coast Citrus Exchange with headquarters in Mobile.

According to the Official Record of the U. S. D. A., Mr. John Graf has been made acting head of truck crop insect investigations of the Bureau of Entomology.

Mr. F. F. Bibby has been transferred from Tlahualilo, Durango, Mexico, to Brownsville, Texas.

J. C. Goodwin is the proud father of a young entomologist.

U. C. Zeluff, the Plant Board Quarantine Inspector stationed at Tampa, has recently intercepted the Mexican orange maggot in a shipment of Mexican oranges from Tampico, Mexico.

D. Marston Bates, youngest member of the Entomological Society, has perhaps the largest collection of lepidoptera in the Southeast. Mr. Bates is but seventeen. He lives at Ft. Lauderdale.

Jeff Chaffin has returned to Gainesville after spending several weeks in Lafayette County, where he was engaged in demonstrating the Florida method of boll weevil control.

Wm. J. Rahn has been employed by the American Fruit Growers Inc. and is located at Wabasso.

J. L. Lazonby is engaged in quarantine inspection work for the Plant Board at Jacksonville.

Chas. A. Reese, formerly Assistant Apiary Inspector of Florida, has moved to Columbus, Ohio.

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SOUTHERN MIGRATION OF BUTTERFLIES

FRANK STIRLING

Not in many years has the southern migration of the Great Southern White, or Gulf Butterfly (*Pieris monuste* L.), been quite so great or noticeable as during the early part of June of this year (1923). Their numbers along the waterways of the east coast of Florida, especially along the Halifax and Indian Rivers, were so great that the radiators of automobiles driving north and south became thoroughly plastered with them. The migration is constantly southward and one wonders where this tremendous army comes from. It seems that they are first noted in large numbers in the vicinity of Titusville and as one travels southward their numbers seem to increase until they reach unlimited millions between Fort Pierce and Stewart, with an apparent increase in numbers as they advance southward. Always they are noted as flying thickest along the edges of the water, such as the two rivers above mentioned, Lake Worth, the East Coast Canal and Biscayne Bay. There they apparently leave the mainland and follow the Gulf Stream to no one knows where. It is not unlikely that these butterflies begin to make up the bulk of their army in such states as the Carolinas and Georgia, for they have been reported in the vicinity of Jacksonville, Florida, on their journey south.

It is observed that numbers of these butterflies occur some three to five miles west of the inland waterways and are always flying eastward, apparently for the purpose of joining the main army in the southward flight. It is not unlikely that many of these butterflies breed and hatch in certain portions of the swamp lands and Everglades of the interior; also in farms and fields where cabbages and collards are grown. These butterflies, upon reaching maturity, apparently follow instictively the eastward

march until the main army is met. On June 8 they were noted in greatest numbers along the coastal sections of eastern Florida and on June 9, 10 and 11 millions of them were noted by travelers coming from Nassau, Bahama Islands, fluttering above the Gulf Stream heading southward.

It would be extremely interesting to understand the purpose of such migrations: where the butterflies come from, that is, how far north do they begin to gather and migrate and where is the place for which they are headed. Is it Cuba, or South America, or do most of them become exhausted and consequently a prey to fish in their journey over the ocean?

But little is known in regard to the food plants of the caterpillars of these butterflies. They may feed on some wild species of plants related to the cabbage and mustard. Noting that so many appear from the Everglades, it is not unlikely that some native host growing in that section of the state is responsible for the breeding of great numbers.

THE PROPER NAME AND DISTRIBUTION OF THE FLORIDA FLOWER THRIPS*

J. R. WATSON

In the literature on Florida insects prior to 1913 our flower thrips was not distinguished from the northern species *Frankliniella tritici* (Fitch), then called *Euthrips tritici* Fitch or *Thrips tritici* Fitch. For instance, Quaintance in Bulletin No. 42 of Fla. Agric. Exp. Sta. refers to a thrips damaging strawberries at Lake City under that name. But his Figure 4, from a microphotograph, shows the second antennal segment with sufficient clearness to prove that it belongs to Morgan's *bispinosa*. Furthermore the known distribution of *tritici* in Florida would make it very improbable that it was the dominant species attacking strawberries as far south as Lake City.

In 1913 Morgan, (Proc. U. S. Nat. Mus. Vol. 46, p. 10) described *Euthrips tritici bispinosa* from four females taken at Dade City. As distinguishing characters he named: (1) the color, "pale yellow shading to gray on sides of head and abdomen." (He does not mention any orange color probably because he described alcoholic specimens.) "Tip of abdomen not darker than remainder of body." (2) "Tip of second (antennal) segment raised dorsally and bearing two exceptionally heavy dark

*Paper presented at the May meeting of the Society.

brown spines." (3) "Segments 3 and 4 relatively much more slender than in *E. tritici*."

Later Hood raised Morgan's variety to specific rank and transferred it with *tritici* and other species of *Euthrips* to Karny's genus *Frankliniella,* naming our insect *Frankliniella bispinosa* (Morgan), and this is the name that has been used by the writer until more data could be collected.

As bearing upon the subject of the specific rank of *bispinosa* two questions needed investigation. Are there transition forms between *bispinosa* and *tritici,* and do the two forms overlap in distribution? Not until recently were we able to gather evidence bearing upon these questions. Specimens sent in from Mississippi, Louisiana, Alabama, and Atlanta, Ga., always proved to be typical *tritici* and all specimens from Florida typical *bispinosa.* During the last few months, however, we have examined a large series from Escambia County in extreme west Florida and from several points in extreme southern Alabama, Mississippi, and Georgia.

An examination of some hundreds of specimens of both forms shows that the color differences as described by Morgan are valueless. There are no constant color differences. Apparently Morgan's description was from alcoholic specimens from which the orange color had faded. *Bispinosa* has fully as much orange as *tritici,* perhaps more. The dark spot on the tip of the abdomen is a variable character present in many specimens of *bispinosa* and absolutely worthless as a distinguishing mark. There remains only the comparative lengths of the third and fourth antennal segments and the dorsal elevation and the two heavy spines of the second antennal segment. In typical *triciti* there is no such elevation. The segment is symmetrical in side view. Also the two spines on the dorsal surface are no heavier than those on segment 3. In both these characters some specimens from extreme western Florida and Gulfport, Miss., are intermediate. Some of these cannot with certainty be placed with either form. Some have the second antennal segment of *bispinosa* but the short third and fourth segments of *tritici.* The lengths of segments 3 and 4 are more variable than the two heavy spines of segment 2. These spines form the most constant distinguishing mark between the two forms.

Since the only characters of any value are those of the three antennal segments and these intermediate in many specimens it would seem that *bispinosa* hardly deserves specific rank as given

by Hood but that it should be considered as a mere variety, though a well-marked one, as originally given by Morgan, and that its proper name is *Frankliniella tritici bispinosa* (Morgan).

In size *bispinosa* averages a trifle smaller than *tritici.* The average total length of several hundred measured was 1.1 mm., while the average of all the tritici in the writer's collection is 1.15 mm. On the other hand, where the two forms meet at Cottage Hill *bispinosa* measured 1.25 mm., while *tritici* averaged 1.09 mm. and at Loxley, Ala., only 1.03 mm. *Frankliniella cephalica masoni* averaged only 1.02 mm.

In regard to the distribution of the variety most of the specimens from Cottage Hill, Escambia County, Fla., were *bispinosa,* but there was a minority of *tritici.* In a collection from as far east as Panama City there were a few *tritici.* On the other hand, a collection from Loxley, Ala., was mostly *tritici* with a sprinkling of bispinosa and the same was true of several collections from near Gulfport, Miss., sent in by Mr. E. K. Bynum of the State Plant Board of Mississippi. It would thus seem that in the west there is a remarkably close coincidence between the dividing line of the two forms and the boundary of the state. On the northern border a collection taken a few miles north of Valdosta, Ga., by F. W. Walker were all bispinosa, while specimens received from Atlanta were all tritici.

We have thus in Florida three yellow, flower-inhabiting thrips of the genus *Frankliniella.* The most common one is *F. tritici bispinosa* (Morgan), which ranges over the entire state and extends but little over the state line in the west but well up into Georgia. *F. tritici* (Fitch) comes into the western end of the state in small numbers. In the south but ranging in small numbers as far north as Daytona is another species, *F. cephalica masoni.* Wats.

ENTOMOLOGICAL NOTES FROM BRAZIL

"The other day the young fellow who is working here in the enclosure as a care taker of the plants hollered for me to come and help him with a big "bicho!" When I got there I found it was a Buprestid that measured over six centimeters in length. Some time ago the servant's daughter brought us a Prionid that measured over eight centimeters in length, not including his antennae.

"We had spent lots of time and exercised lots of care in getting some really magnificent things that Mr. Haddon took through for

Mr. Van Hyning. But then you know that Mr. Haddon made the fool blunder of placing them in the mail for the last lap of the journey, in spite of the fact that I had warned him and specifically instructed him to send them by express. I knew of course that if they were sent in the usual envelopes and folded in the usual way that Mr. Van Hyning could not possibly get time to take care of them for years to come.

"The last four weeks have been unusually prolific ones in the way of collecting moths at the electric light. Most of them are of medium or small size but a lot of them very fine and interesting. We have gotten a couple of larvae of very large and interesting Sphingidae. Lately the Heliconidae butterflies have become quite abundant. Clarissa got some rather interesting ones today. Yesterday I saw one specimen of the clear-winged Heliconidae. I had no net with me so could not get him. The day before I had seen two of that species at Ponte Nova. The chrysalis of one of these Heliconidae is of burnished silver, about as bright as a mirror. It takes only about a week from the time of pupation until the butterfly emerges. The other day I got fourteen of them from a single *Sylanium*. For the last three or four weeks leafhoppers have become very abundant at the light. Apparently they are of quite a number of different species. At the beginning of the rainy season I made some sweepings over grass plots but caught practically no leaf hoppers."

P. H. ROLFS.

April 3, 1923.

REPORTS OF MEETINGS OF THE SOCIETY

April 30, 1923.

Society met in Language Hall with Vice President Rogers in the chair. Members present: Ayers, Berger, Beyer, Brown, Burger, Chaffin, Merrill, Mowry, Montgomery, O'Byrne, Rogers, Stirling, Trigg, Walker, Watson. Visitors, Jenkins, Link, and Heuse.

Mr. Ayers gave the first paper on "Insect and Plant Disease Problems Occurring in the Field." Among the insect problems mentioned by Mr. Ayers were the camphor scale, flower thrips, celery leaf-tyer, and garden flea hopper. Spraying was done for the control of thrips. Poisoned bran bait moistened with nitro-benzine was used with success on the leaf-tyer. Calcium cyanide dust was also used for control of the leaf-tyer, as well as the garden flea hopper. It was thorough and effective in its control of the latter but not the former.

A. H. Beyer, the next speaker, reported an infestation of *Aphis maidis-radicis*, on the roots of watermelons collected by Prof. Watson near Live Oak. He also discussed the difficulty in the control of this pest.

Under "Brief and Timely Notes" Dr. Montgomery mentioned Baker's mealy bug, as being a probable threatening pest to the grape industry of Florida.

May 25, 1923.

Society met in Language Hall with President Merrill in the chair. Members present were Berger, Beyer, Brown, Merrill, Stirling, Stone, Trigg, Walker, and Watson. Visitor, Mr. Link, who was elected a member of the society.

The first subject was a round table discussion of the proposed anti-mosquito campaign in Gainesville, led by F. M. O'Byrne.

The speaker first discussed the effect on the health and comfort of the community as well as real estate values and civic pride. He reported that the Gainesville Board of Health had adopted the Model Mosquito Ordinance which was adopted by the State Board of Health, and that the campaign was costing about $500, which is being expended for inspectors, etc. Lack of funds prevents any drainage work being done at present. Among the mosquito breeding places discussed, which should be abolished or oiled, were barrels, bottles, tubs, pans, and tin cans. They were also found breeding in septic tanks, storm sewers, holes in bark of trees, cup depressions on exposed roots of trees, seepage places in land, and bodies of water where minnows and other enemies of the mosquito do not occur.

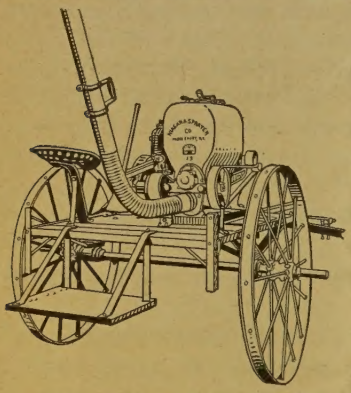
The next speaker, Professor Watson, spoke on the proper name for the Florida flower thrips.

A. H. BEYER, Secretary.

THE SYCAMORE LACE-BUG

It was late September and the Florida landscape was one unbroken green. Drenched by the almost daily showers and heavy dews of the rainy season which had just closed, the grass was at its greenest. The weeds of the neglected fields and other waste places had as yet hardly commenced their automn carnival of color. The native trees, too, except for an occasional half-drowned red maple or sour gum in a flooded swamp, had scarcely turned a leaf. In vain did the tired eye seek a bit of color in this mo-

notonously green landscape. But there was one exception. The sycamores planted along our streets and lawns were brown, sear and half bare. Why should they alone of all the trees on well-drained land be dropping their leaves? Let us examine the withered foliage. On the under side we find numerous reddish brown stains—so characteristic of tingids. A closer scrutiny and we see, in the middle of some of the fresher stained areas, the bugs themselves. Under the lens the entire body is seen to be covered with the most delicate net of thickened veins and ridges which gives these insects their name of lace bugs. And they or their stains were on every leaf. What a fearful epidemic is this! The worst human epidemic of which we have any record, the plague or black death of medieval Europe, is said to have taken over half of the population. But here is an epidemic which has taken nearly 100%. And it is a yearly event. Luckily for the trees it occurs late in the season, after much of the work of the leaves is done. Still it must be a handicap to the sycamore tree and one wonders if this may not be one of the reasons why the sycamore does not grow wild in our hammocks.



NIAGARA COMBINATION DUSTER

This is the Niagara Power Potato Duster. Shown here fitted with flexible distributor pipe and drop platform for use in orchard dusting. For grower having both orchard and low crops to protect. Only driver needed for dusting potatoes, etc. Driver and one man to operate distributor pipe needed for orchard use.

DUSTING costs less than liquid spraying. Dusting materials cost more than materials for liquid spraying, but this is more than counterbalanced by the big saving in time and labor, less cost of the duster, and much smaller depreciation, repairs, and operating cost.

Dusting differs from spraying chiefly in that Insecticides and Fungicides are applied in a powdered form; dry instead of wet. Water merely carries the active ingredients to the plant, where it evaporates and leaves a dry powder. Spraying requires 50 lbs. of water to carry 1 lb. of poison to the foliage. In dusting air is the carrier; it is ever present and does not have to be pumped and carried. The chemicals used are fundamentally the same with either product.

For further information write our Distributor

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Orlando, Fla.

NIAGARA SPRAYER COMPANY
Middleport, N. Y.

"BLACK LEAF 40"

(Sulphate of Nicotine—40% of Nicotine)

For liquid spraying against aphis, thrips, leaf-hoppers, etc. May be combined with other standard spray-chemicals. Always dependable and efficient.

"Black Leaf 40" is, in Very Truth, "The Old Reliable"

PRICES

½-lb. tin	$ 1.25
2-lb. tin	3.50
10-lb. tin	13.50

"BLACK LEAF"-F1-NICOTINE DUST

Contains Over 1¼% of Actual ("Free") Nicotine

Made from our own high-strength ("Free") Nicotine. Thoroughly standardized as to strength and texture. Recommended for dusting vegetables to destroy aphis.

PRICES

F. O. B. Richmond, Va.

5-lb. tin	$ 1.10
25-lb. drum	3.75
50-lb. drum	6.75
100-lb. drum	12.75

"BLACK LEAF"-F2-NICOTINE DUST

Contains Over 2% of Actual ("Free") Nicotine

Is stronger in nicotine than our—F1—Dust, but otherwise, is the same. Recommended against the more resistant insects, such as cucumber beetle, pea aphis, etc.

PRICES

F. O. B. Richmond, Va.

5-lb. tin	$ 1.30
25-lb. drum	4.75
50-lb. drum	8.75
100-lb. drum	16.75

"Black Leaf" products are sold by seedsmen, hardware stores, drum stores, general merchants, and dealers in horticultural supplies.

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LOUISVILLE, KENTUCKY

THE HOST OF THECLA HALESUS

While in Gainesville last March Mr. Geo. B. Pierson, an enthusiastic butterfly hunter of Los Angeles, Cal., captured a caterpillar feeding on mistletoe. After leaving Gainesville Mr. Pierson was successful in raising this caterpillar to maturity. It turned out to be the hair streak butterfly, *Thecla halesus*. Holland in the "Butterfly Book" states that not much is known of the early stages but quotes Abbott to the effect that it occurs on oaks.

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